Status of Sacramento River Winter Run Chinook Salmon: What is Needed to Achieve Viability?

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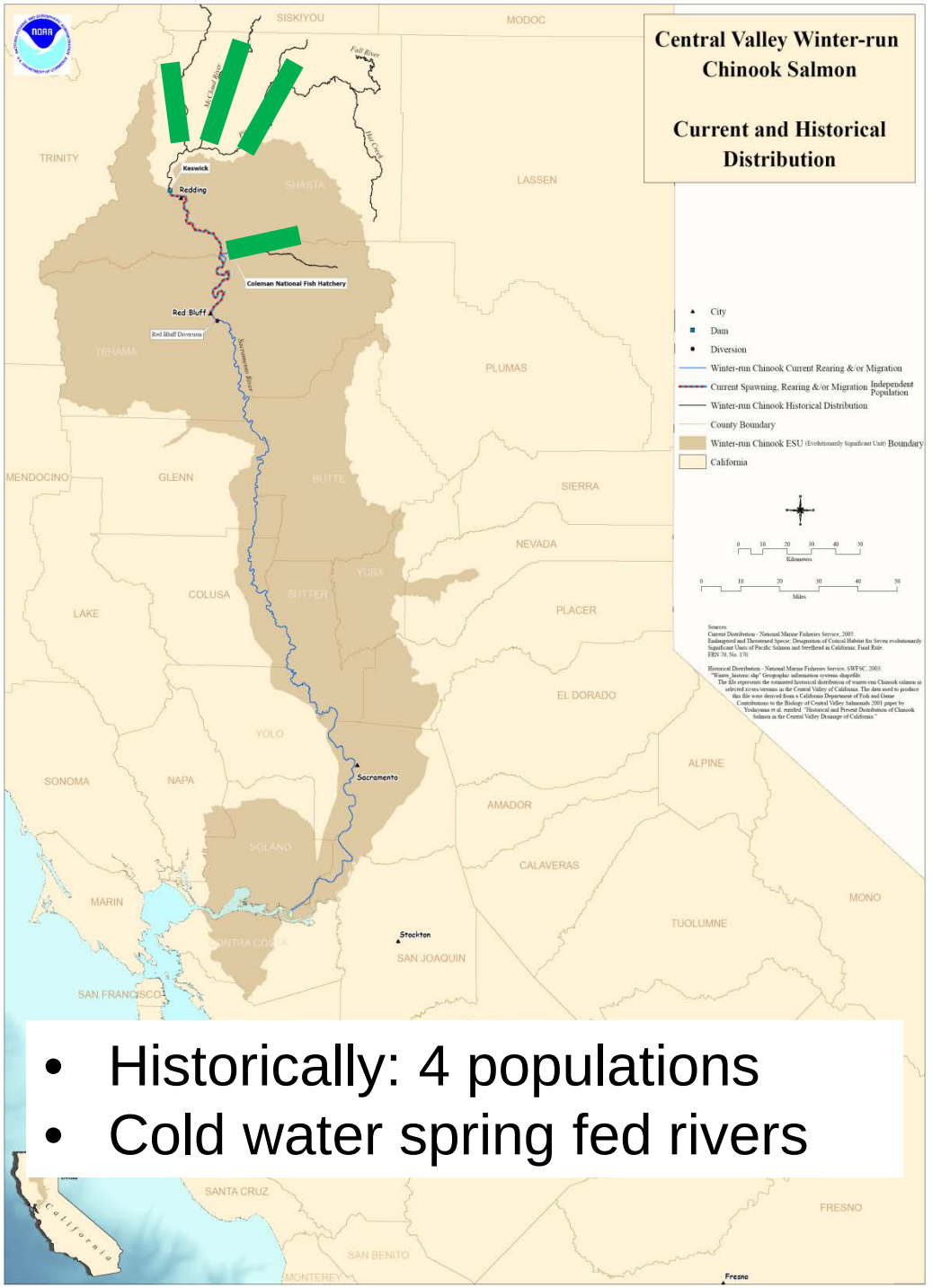
Winter-run Chinook salmon

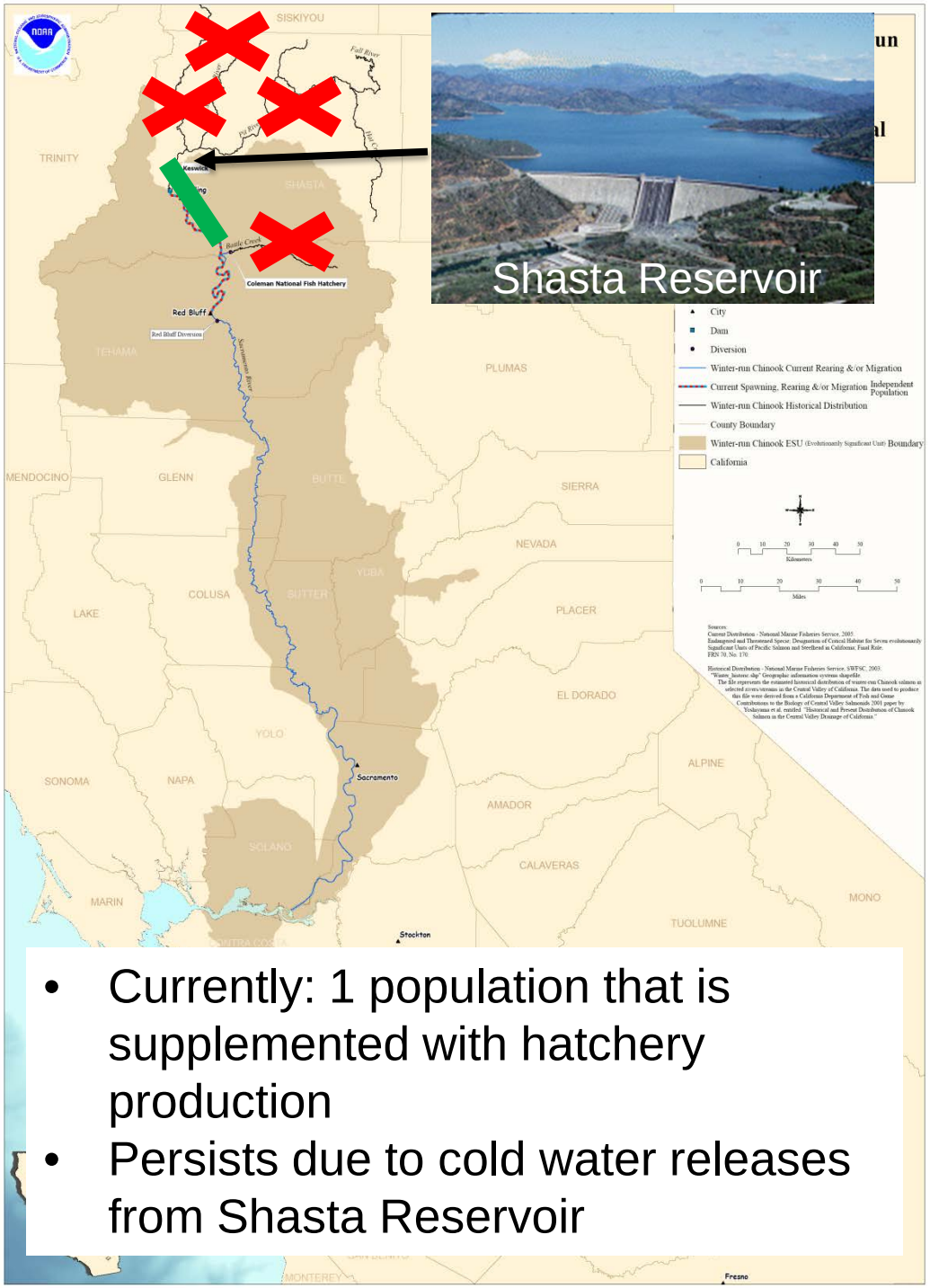
Historical Distribution



- Historically: 4 populations
- Cold water spring fed rivers

Winter-run Chinook salmon

Current Distribution

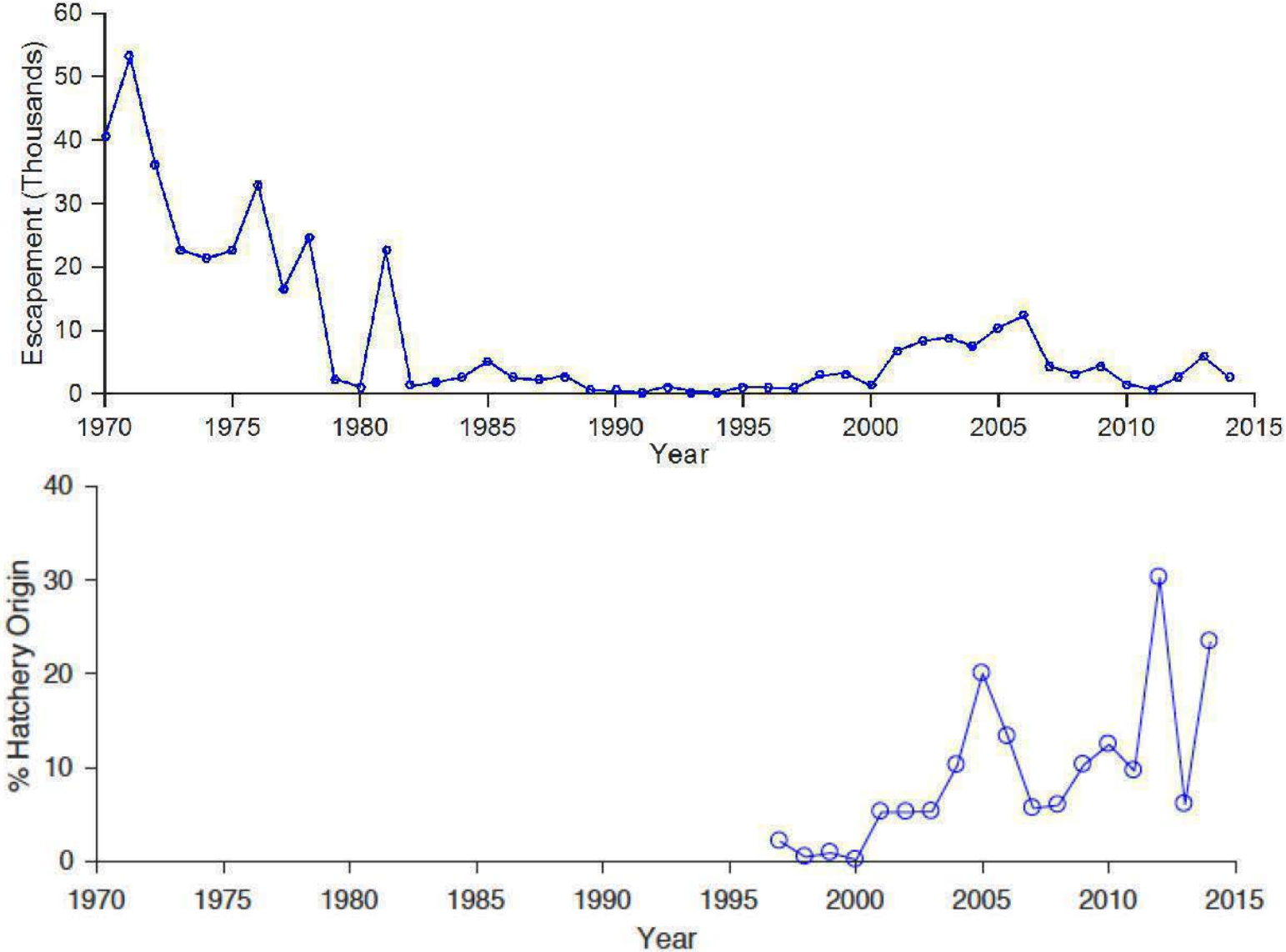


- Currently: 1 population that is supplemented with hatchery production
- Persists due to cold water releases from Shasta Reservoir

Viability criteria: populations

	Risk of Extinction		
Criterion	High	Moderate	Low
Extinction risk from PVA	> 20% within 20 years	> 5% within 100 years	< 5% within 100 years
	– or any ONE of –	– or any ONE of –	– or ALL of –
Population size[a]	$N_e \leq 50$	$50 < N_e \leq 500$	$N_e > 500$
	–or–	–or–	–or–
	$N \leq 250$	$250 < N \leq 2500$	$N > 2500$
Population decline	Precipitous decline[b]	Chronic decline or depression[c]	No decline apparent or probable
Catastrophe, rate and effect[d]	Order of magnitude decline within one generation	Smaller but significant decline[e]	not apparent
Hatchery influence[f]	High	Moderate	Low

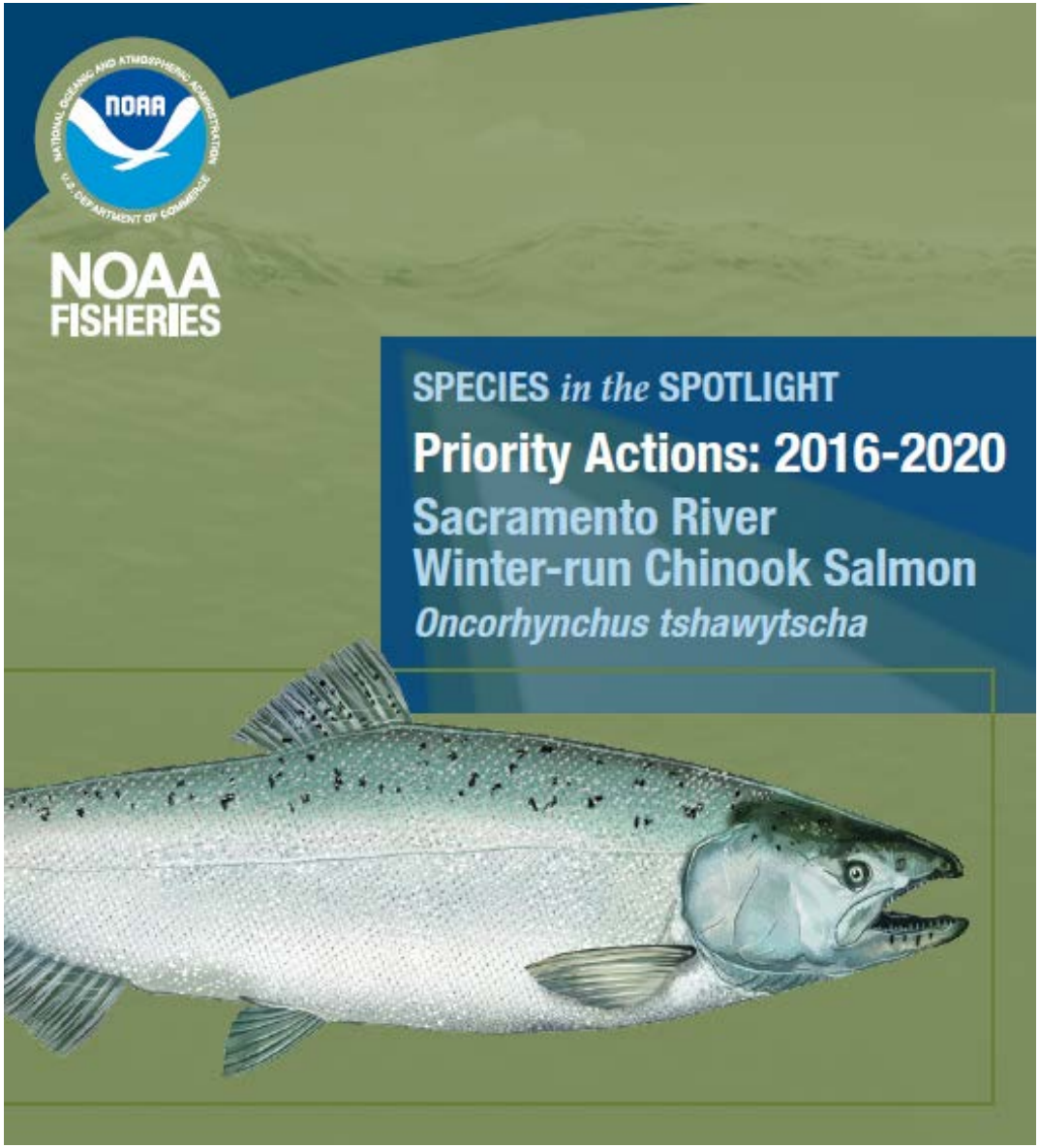
Winter-run Chinook Salmon Adult Returns



Winter-run Chinook salmon

Recovered Spawning Distribution

- 3 spawning areas, each meeting low extinction risk criteria



- Shasta Reservoir Temperature Management
- Battle Creek Restoration & Reintroduction
- McCloud River Reintroduction
- Yolo Bypass
- Delta Conditions

Winter-run Chinook Salmon Action Plan

Life cycle approach

Key actions are needed at each life stage

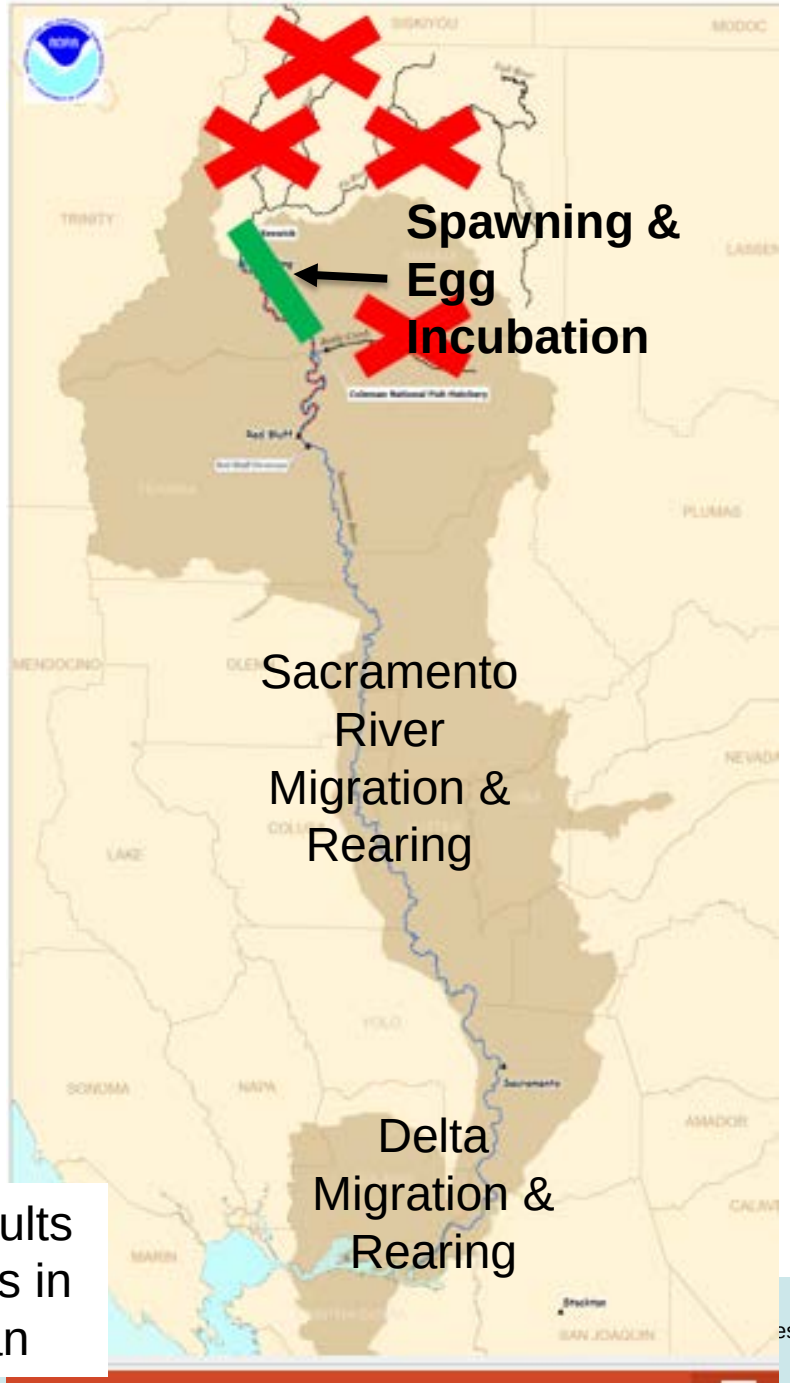
Sub-adults & Adults in Ocean

Winter-run Chinook Salmon Action Plan

Action 1:

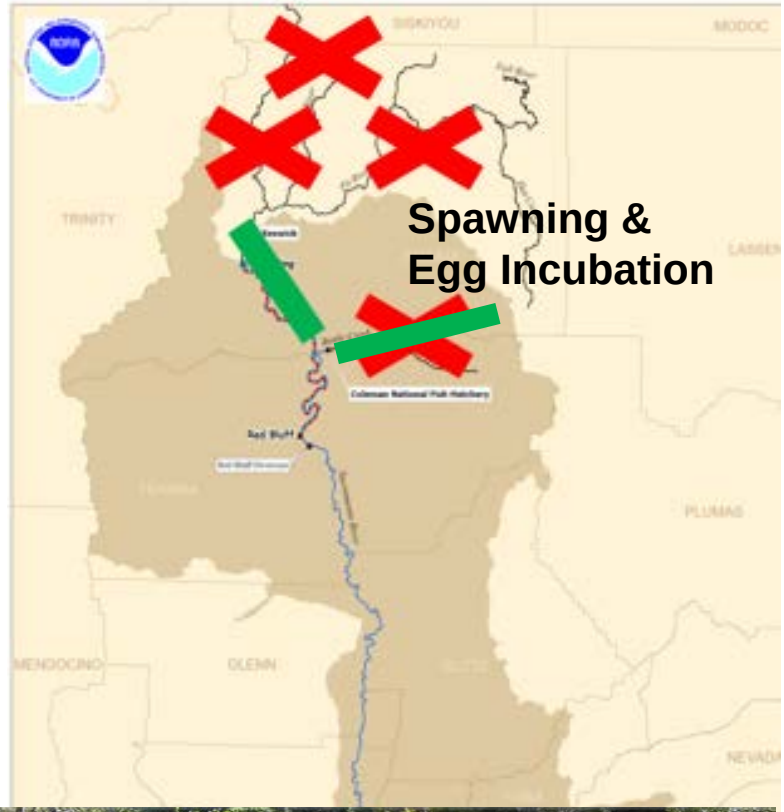
Water temperature management for spawners, eggs, and fry

- Model advances (RAFT)
- Improved measurements
- Partnership with senior water rights holders/rice growers
- Physical modifications
    - -Oak Bottom Temperature Curtain



Sub-adults & Adults in Ocean

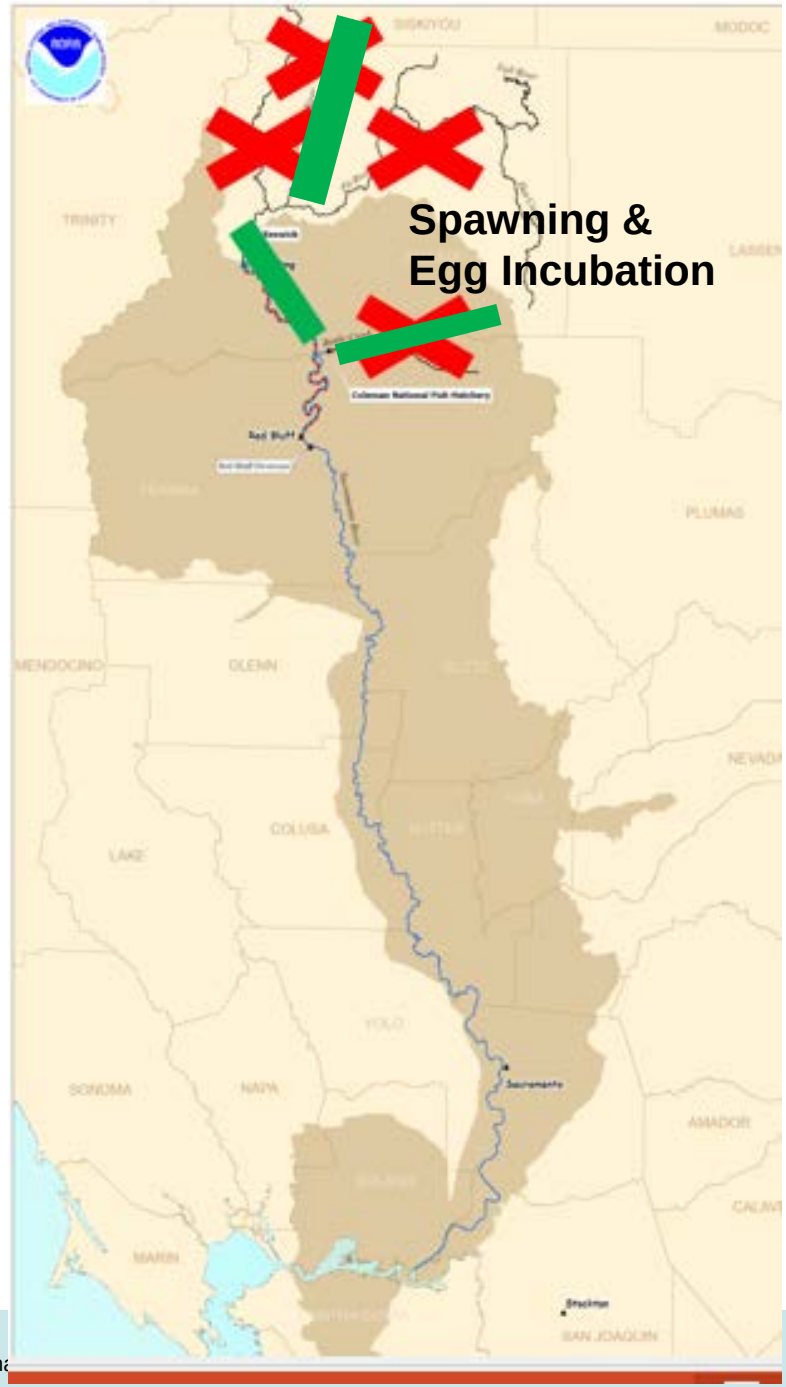
Winter-run Chinook Salmon Action Plan

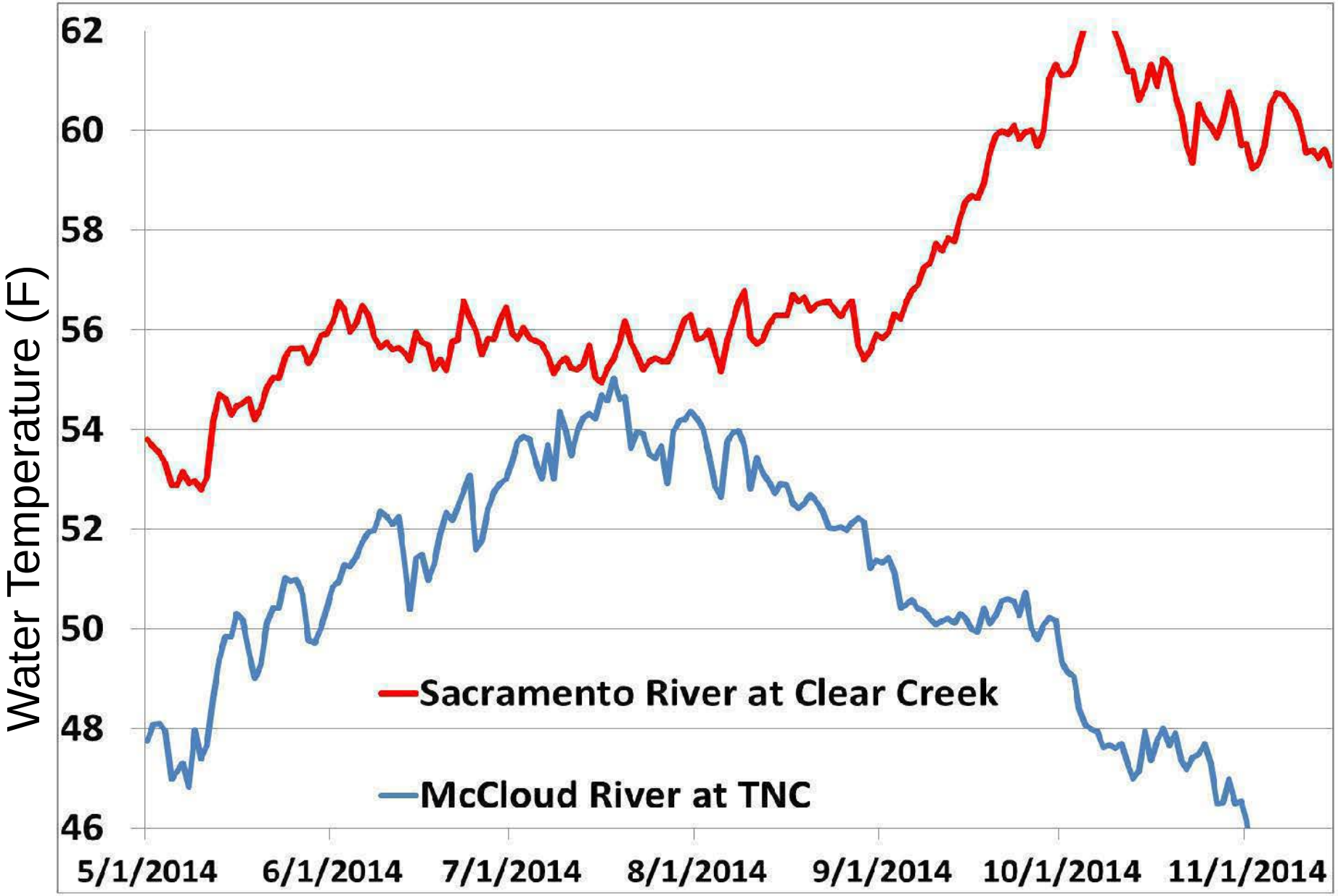


Action 2:
Battle Creek Restoration and Reintroduction

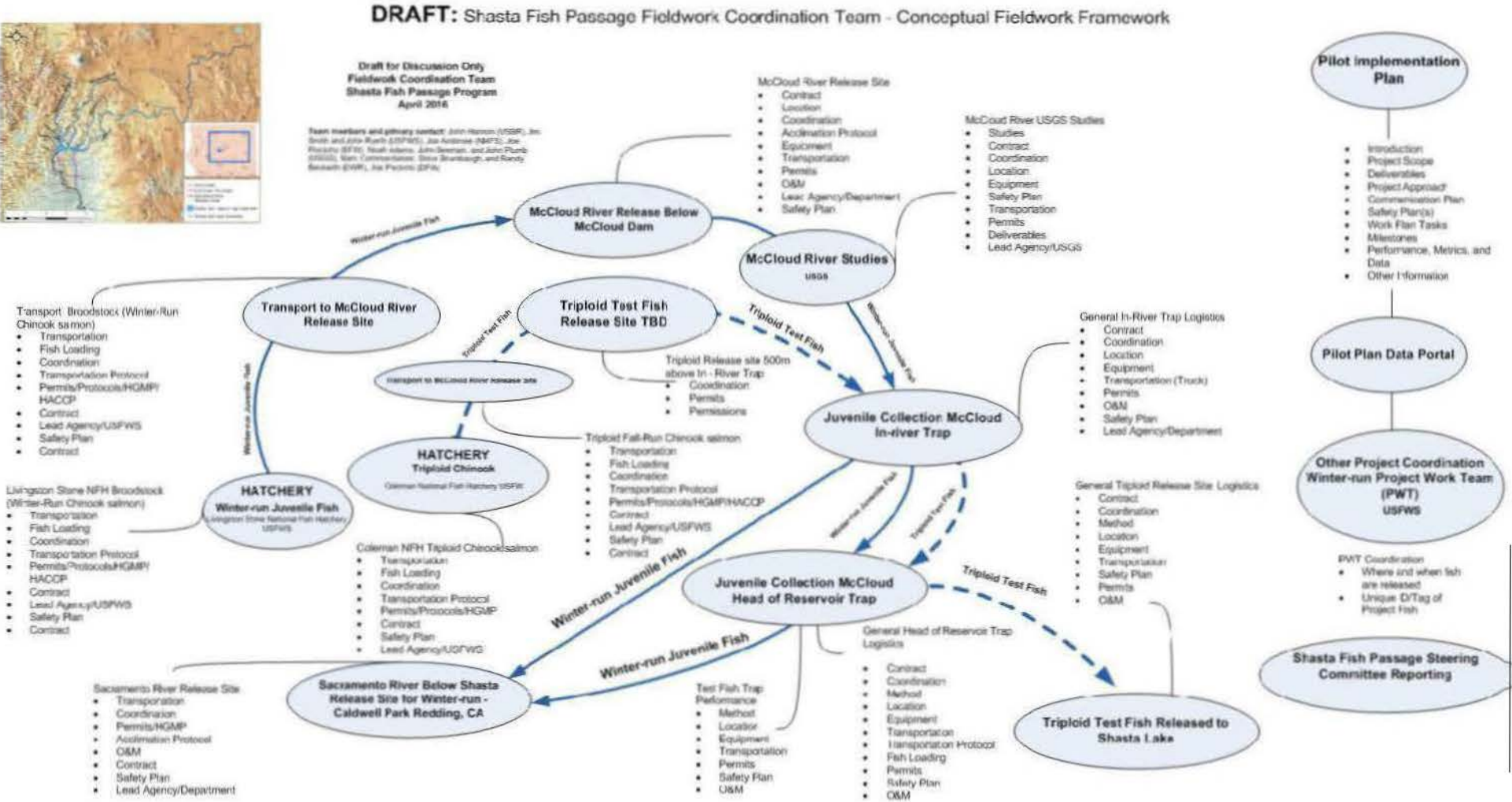
Winter-run Chinook Salmon Action Plan

Action 3:
McCloud River Reintroduction



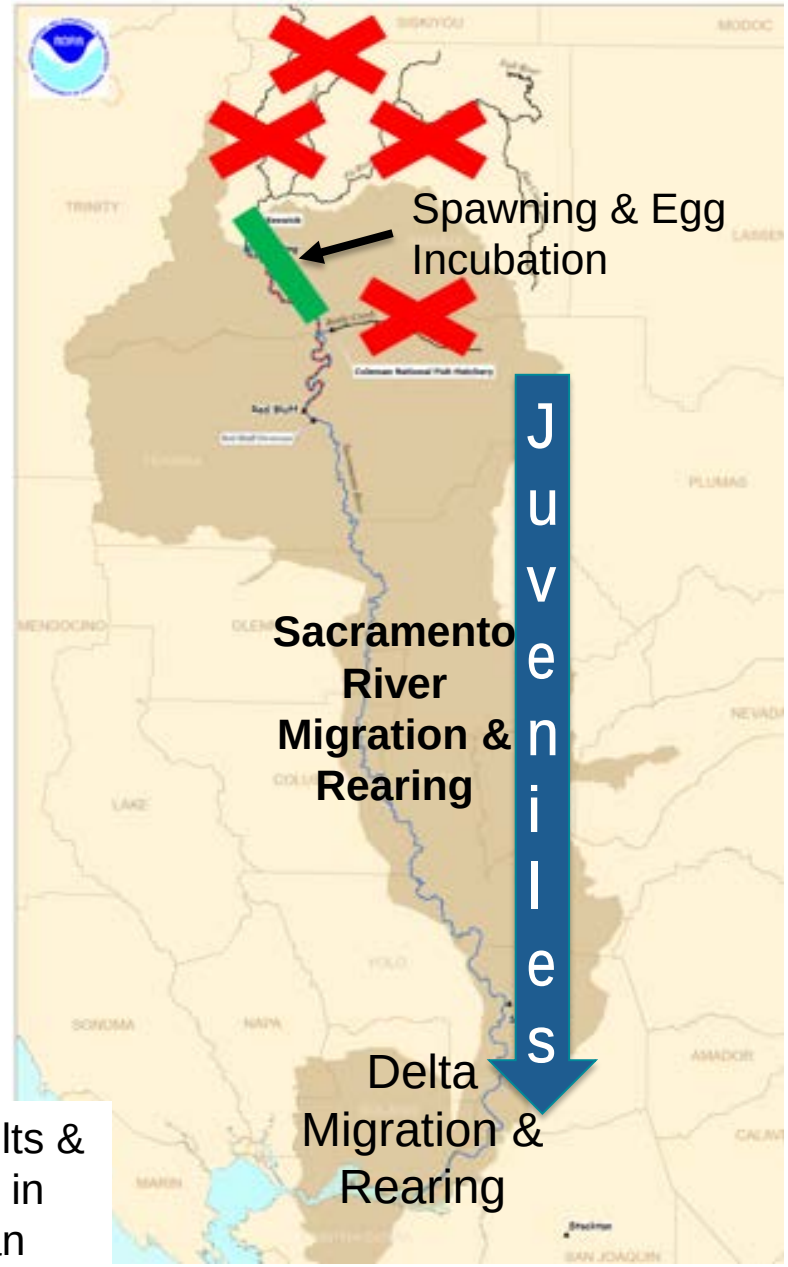

Water Temperature (F)
62
60
58
56
54
52
50
48
46
5/1/2014
6/1/2014
7/1/2014
8/1/2014
9/1/2014
10/1/2014
11/1/2014
Sacramento River at Clear Creek
McCloud River at TNC

McCloud Pilot Reintroduction Fieldwork Framework



Winter-run Chinook Salmon Action Plan

Action 4:
Improve Yolo Bypass Fish Habitat and Passage



Yolo Bypass And Its Sources

Sacramento River

http://www.sacbee.com/news/local/article66971182.html

https://yolobypass.wikispaces.com/

Winter-run Chinook Salmon Action Plan

Action 5:
Managing Delta Conditions:

- Implement CVP/SWP operations to minimize reverse flows

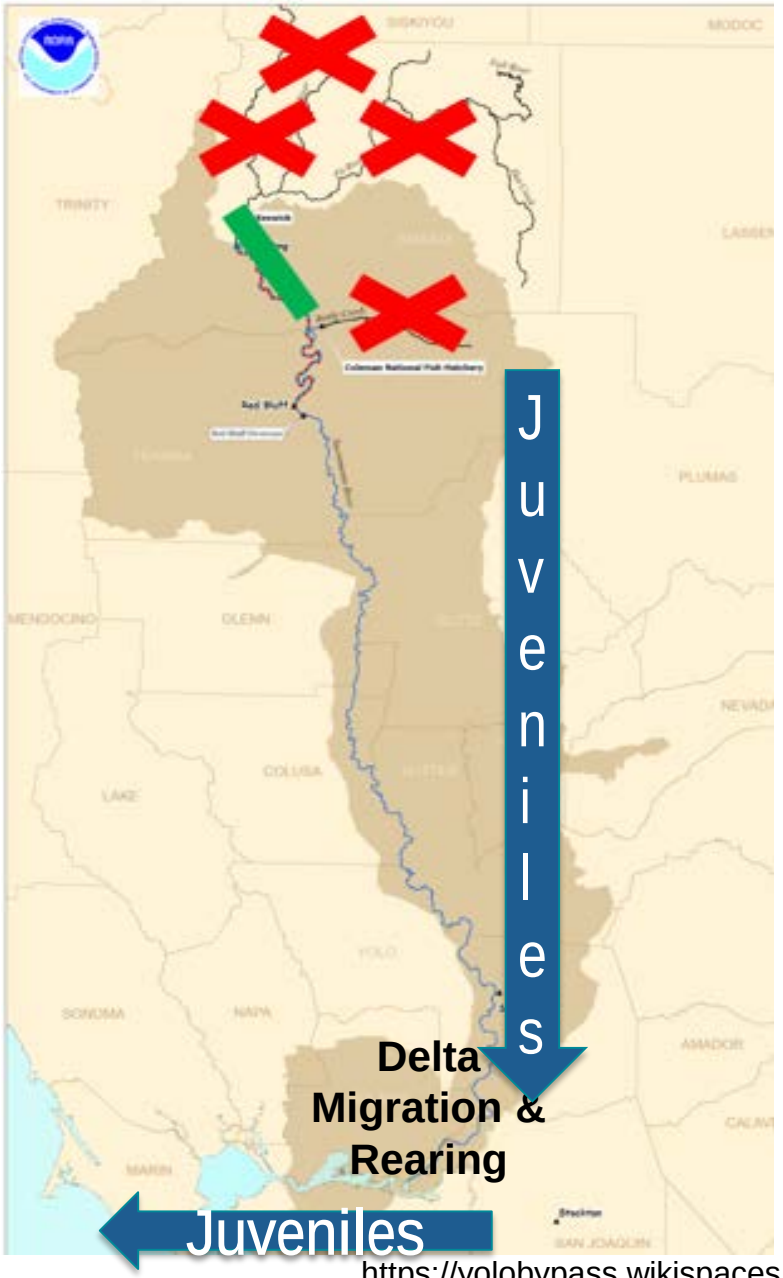
- Continued commitment to science, monitoring, and adaptive management

- Real-time acoustic telemetry

- Particle tracking model

- Non-physical barriers

Sub-adults & Adults in Ocean

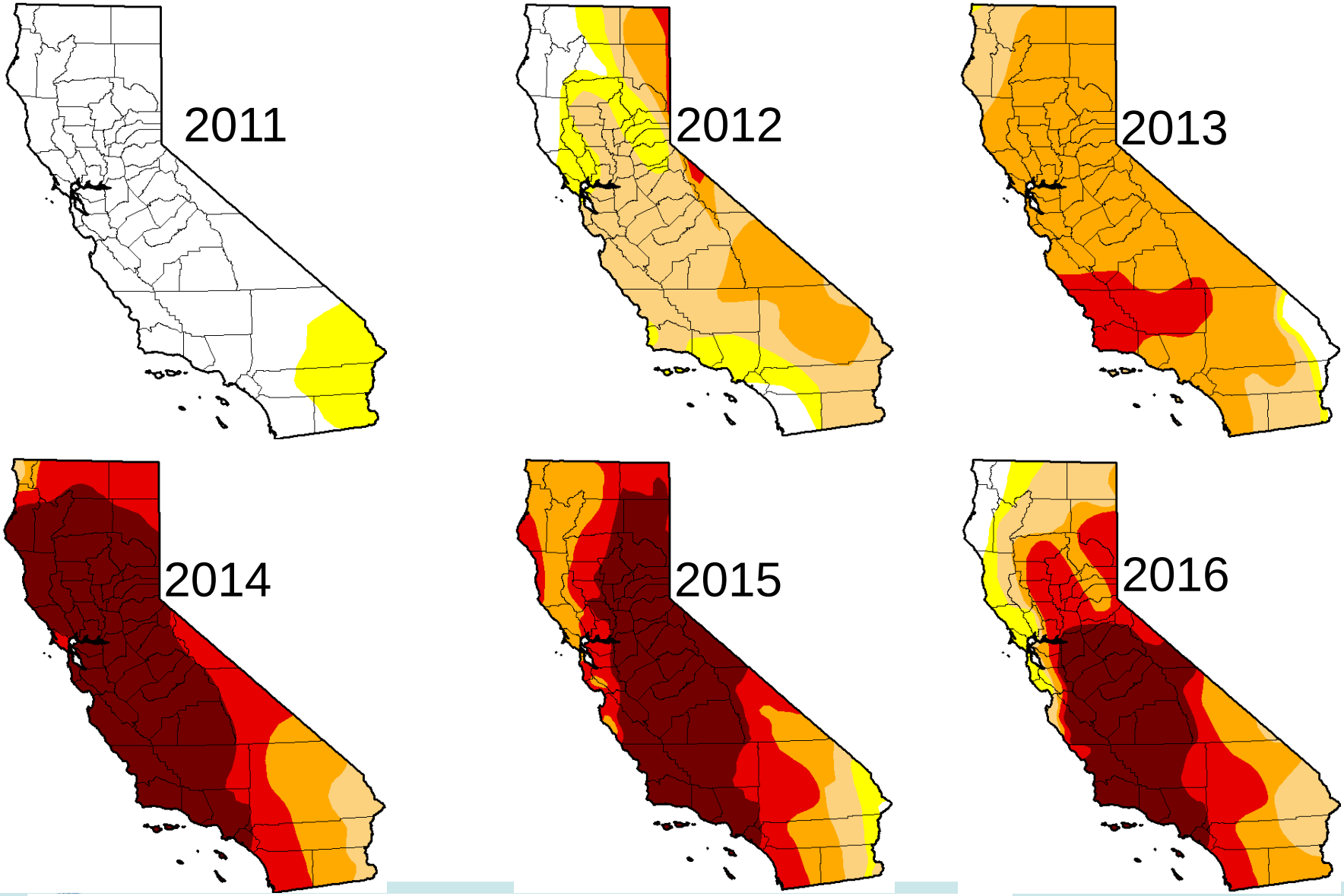


https://yolobypass.wikispaces.com/

Creating usable science in response to management drought challenges

- NMFS RPA relies on **seasonal planning and predictions**
- **Decision tree** approach that accounts for variability and has **performance metrics** to be achieved over time
- **February forecast** is key decision point to set allocations/operations – significant uncertainties in predicting summer temperatures. 90% goal.
- **May temperature plan** – want to optimize expenditure of cold water and predict survivals
- **Fall carryover storage and releases**

Drought Monitor 2011 - 2016



Source: https://www.drought.gov/drought/california

Lessons learned on Shasta Temp management

- Sensitivity of cold water to spring releases; partnership with rice growers to reschedule water
- Need enhanced coupled reservoir model to create better tool for February forecast decision to achieve 90% goal
- Assumptions on ambient air temps are important
- TCD – last side gate operation by Oct 15th is new planning metric
- Survival model based on lab data was not reliable for decision support in 2015
- 56 DAT over most downstream redd is not protective – looking at 55 7DADM
- Tracking weekly conditions against modeled predictions may create better management framework than real-time conditions alone.

Questions?

Evolution of information on Shasta Temperatures

2014: February standard temperature model predicted 56 degrees could be met throughout summer – in fact ran out of cold water in August.

Learning:

– Reschedule spring releases to rice to enhance cold water

- Added more conservative ambient temps to model

- Delay last side gate operation at TCD to Oct 15th,

2015: February standard temperature model predicted 56 could be met throughout summer, with buffer. Survival model predicted low mortality for 57 degrees. In fact, less cold water than predicted; significant mortalities in 2015

Learning:

- Need real-time fiber optic cable, coupled reservoir model with explicit uncertainties
- Develop new survival model using RAFT and RBDD data
- Explore causal mechanisms of high mortality

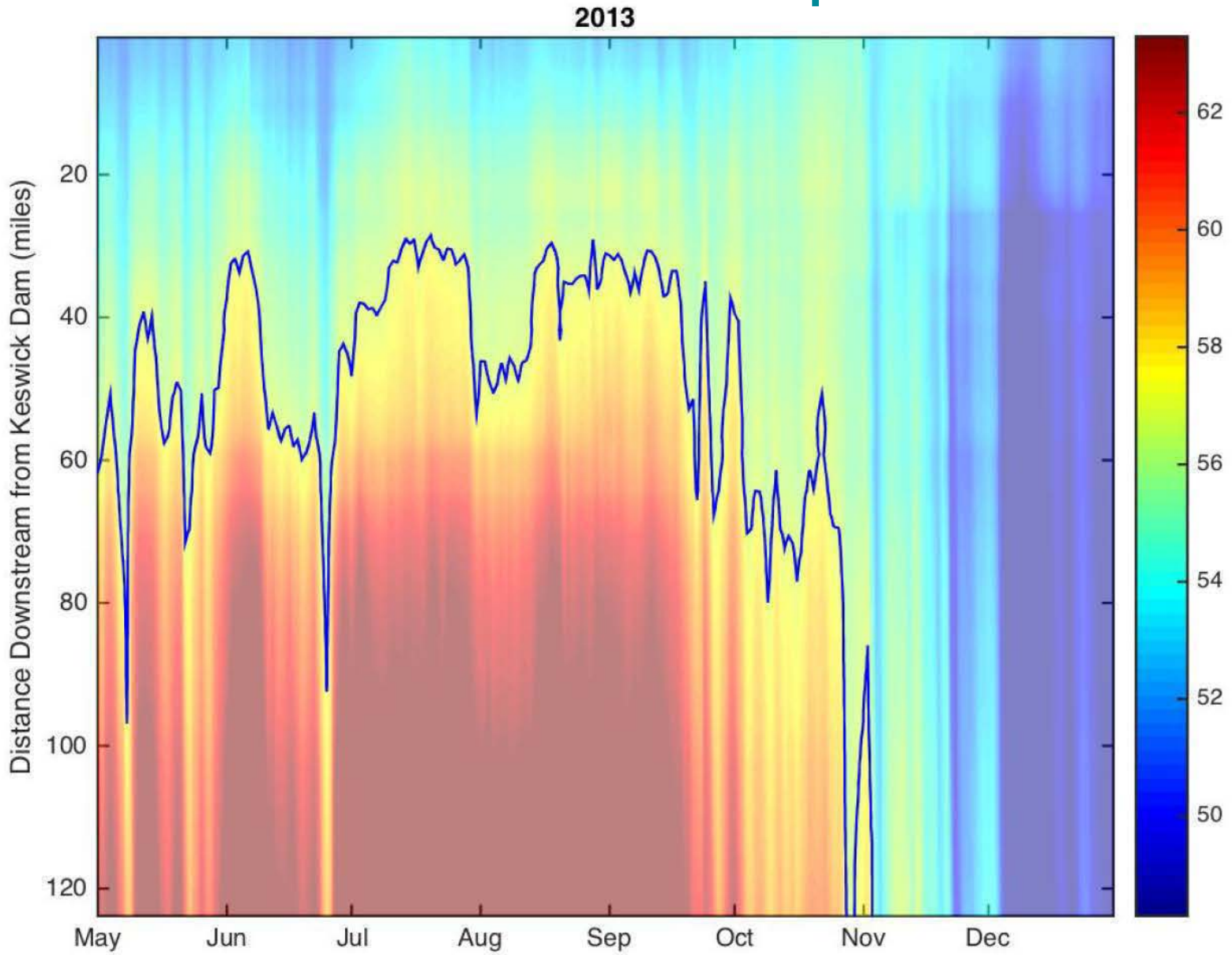
Evolution of information on Shasta Temperatures

- 2016 – Planned for colder temperatures at most downstream redd (55 7DADM as a “pilot”)
- Used 52 degrees at Keswick, real-time reservoir profiles, and spring storage targets to enhance existing model interpretations.
- Conservative approach to spring releases to account for uncertainties in lake stratification (new model in development)
- Summer management: tracked rate of expenditure of cold water against what was modeled. Triggers in plan.

Results: Successful temperature management

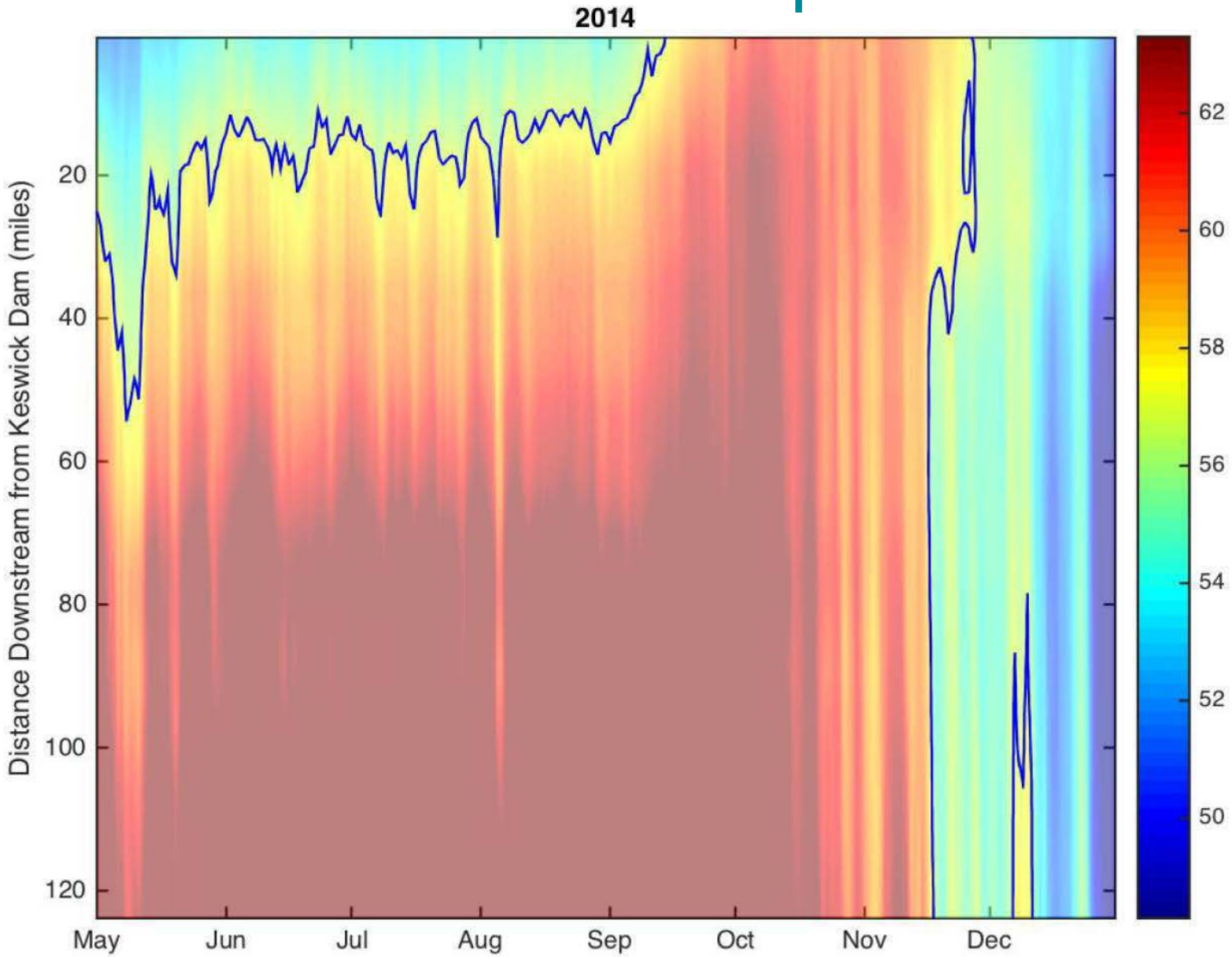
EXTRA SLIDES TO POTENTIALLY USE

Sacramento River Water Temperature - 2013



Slide provided by Eric Danner NMFS SWFSC

Sacramento River Water Temperature - 2014



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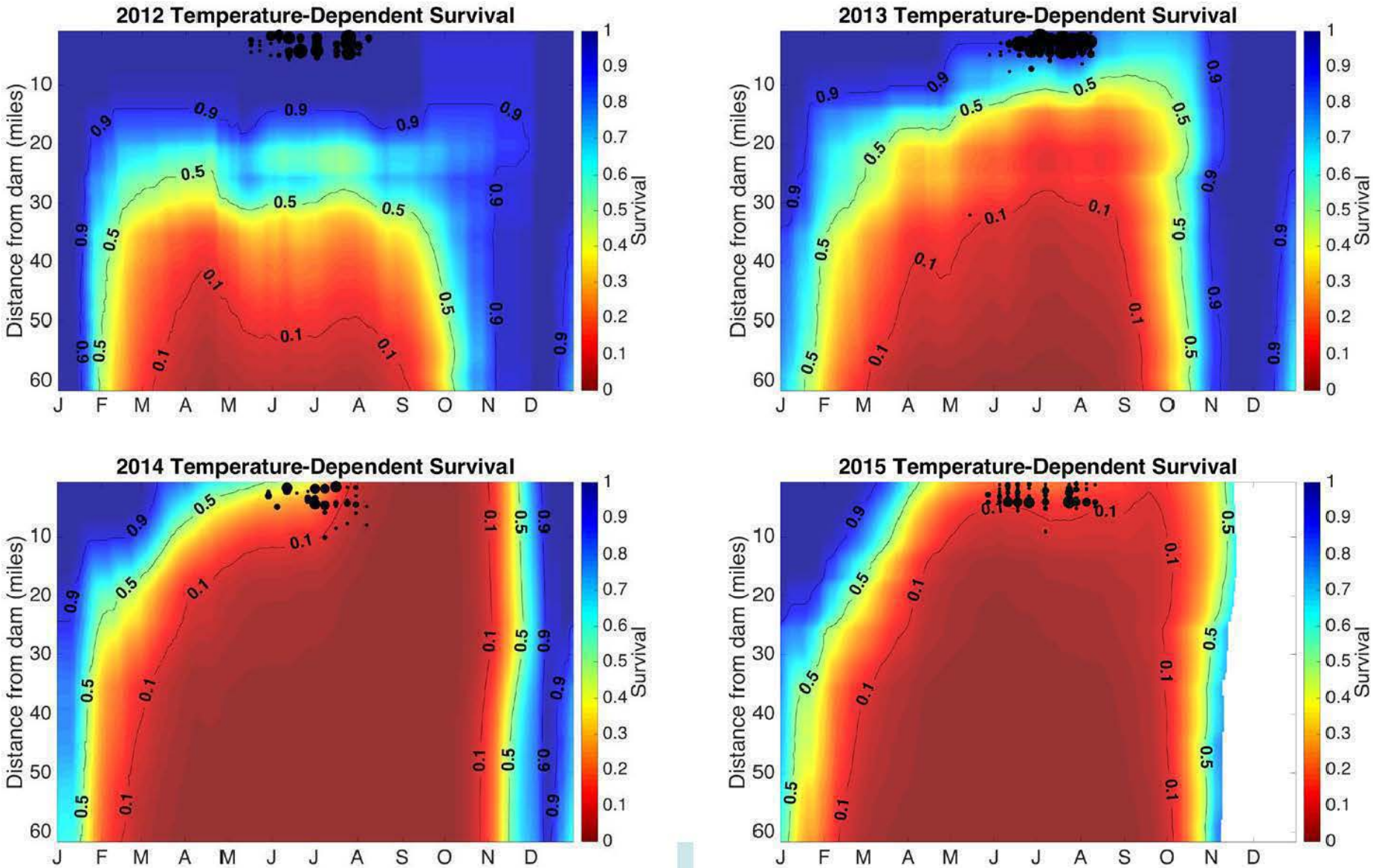
Winter-run Egg Survival Probability



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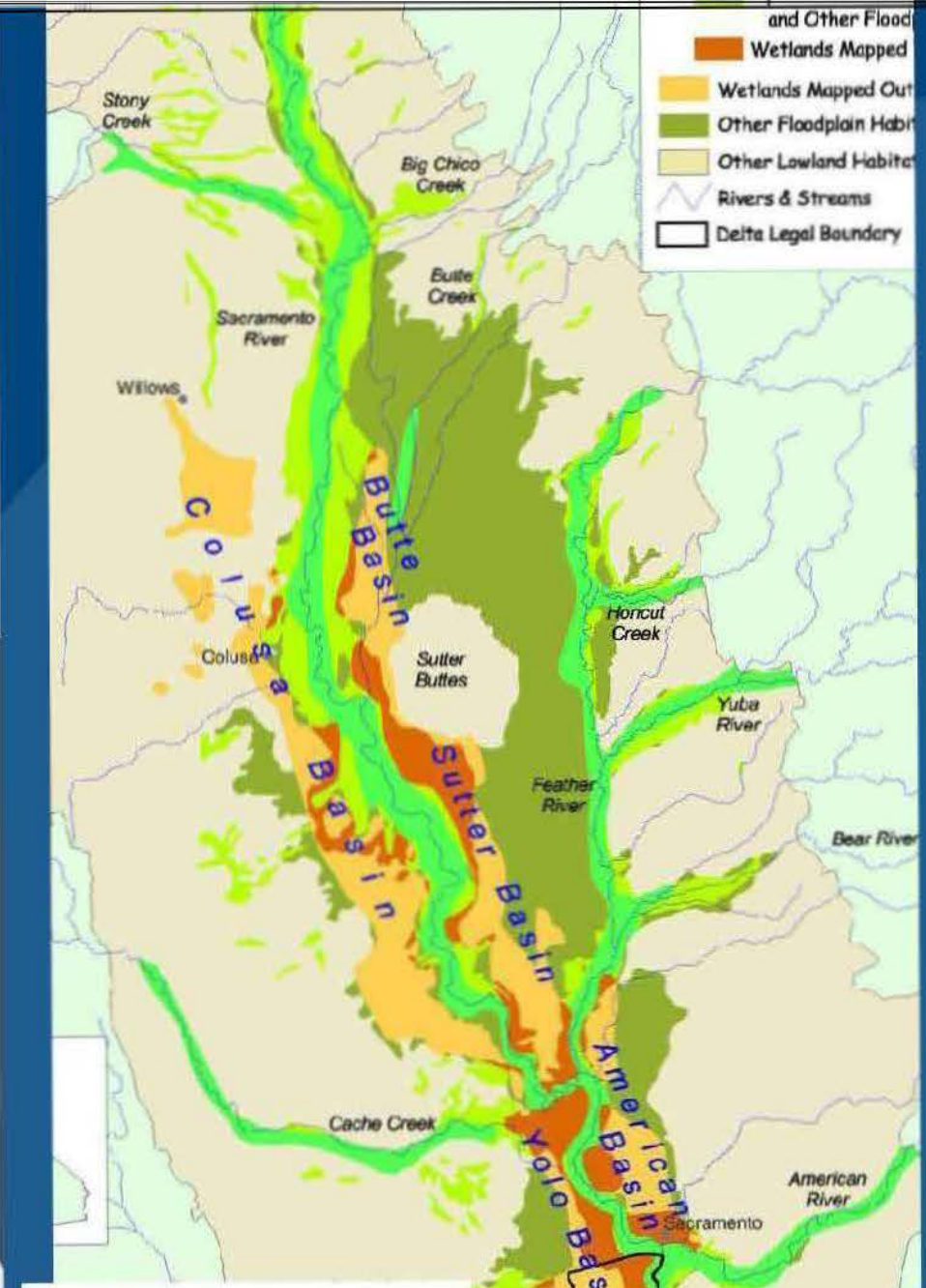
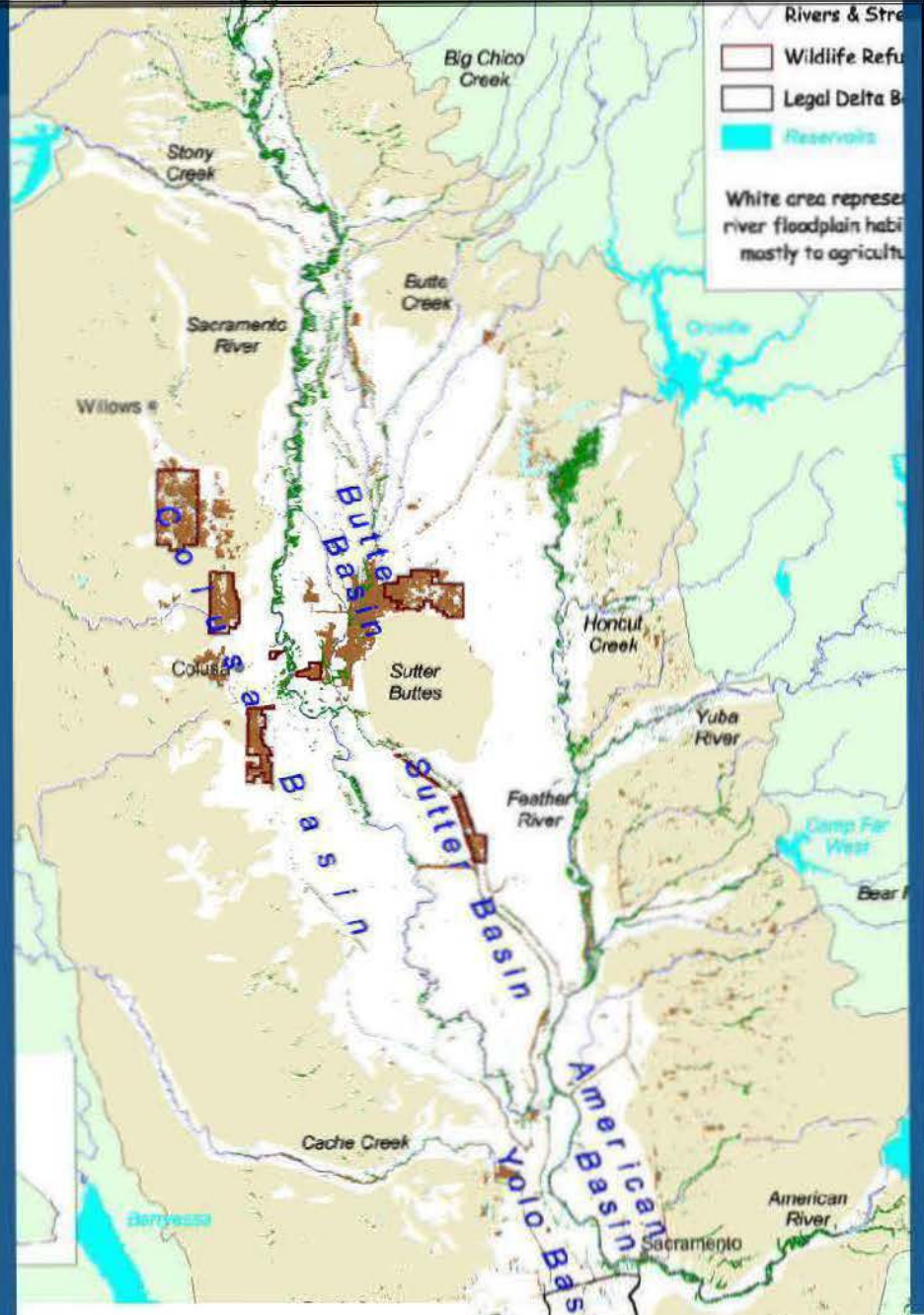
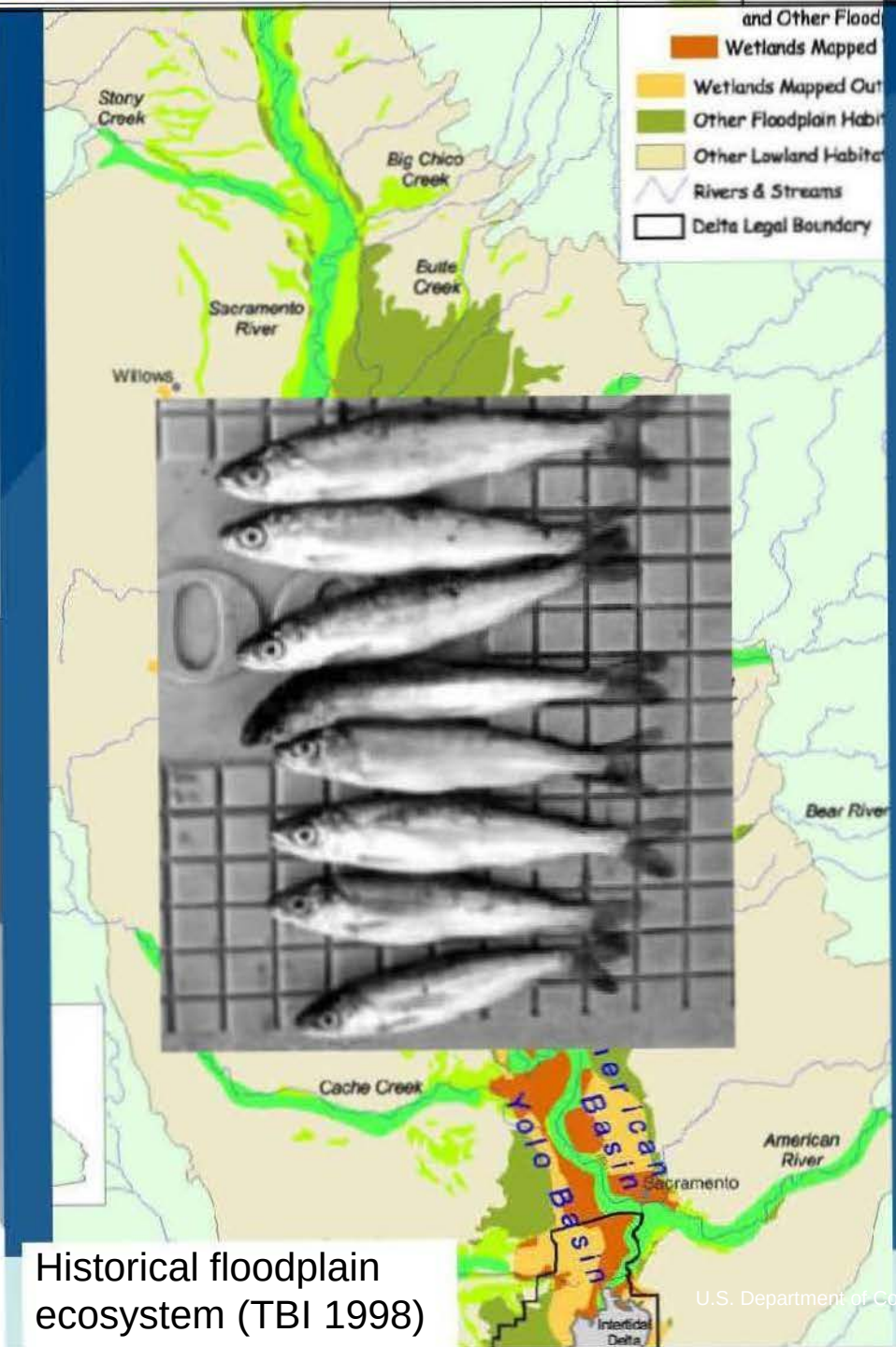


Historical floodplain ecosystem (TBI 1998)



Recent floodplain ecosystem (TBI 1998)



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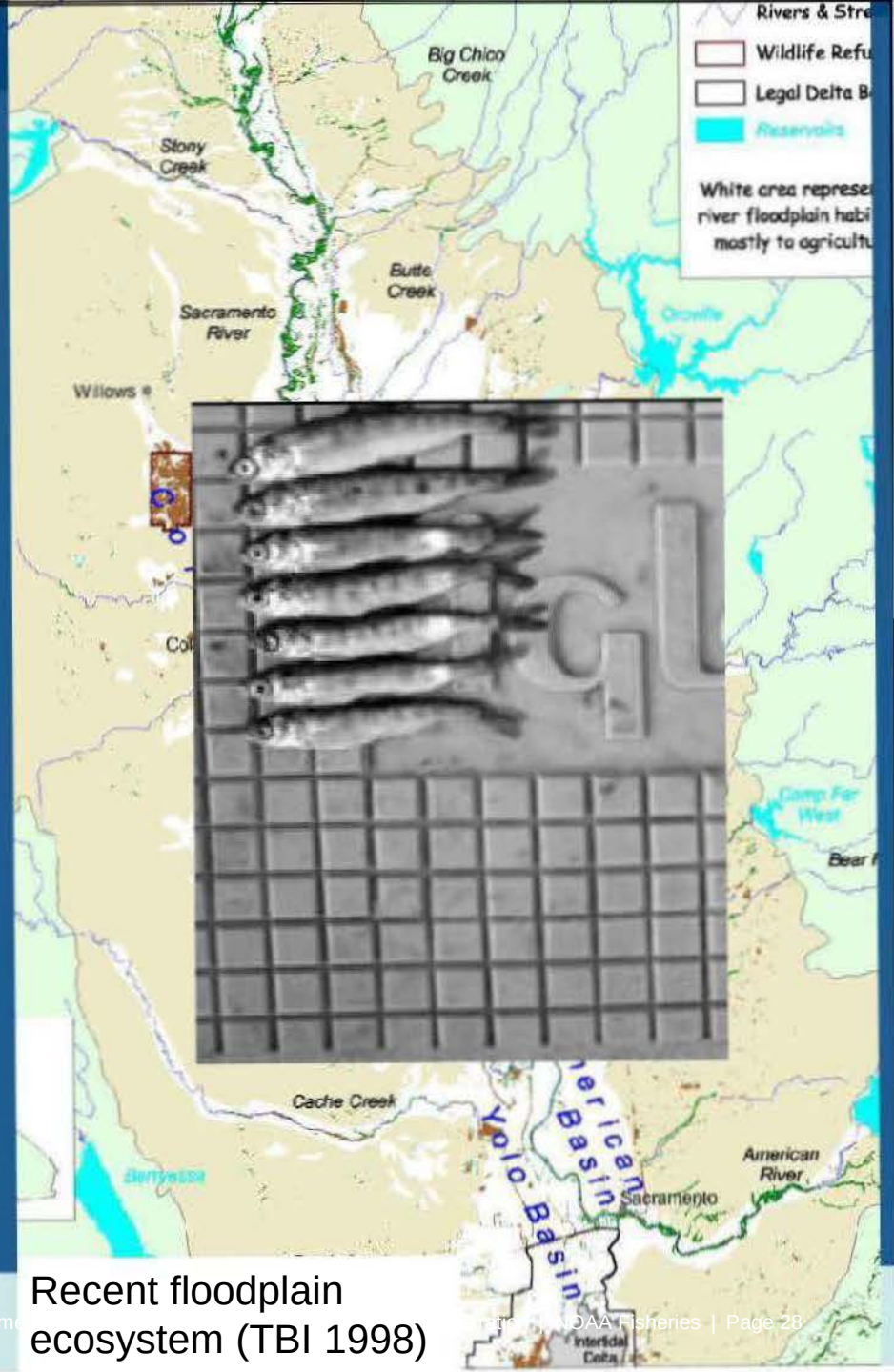

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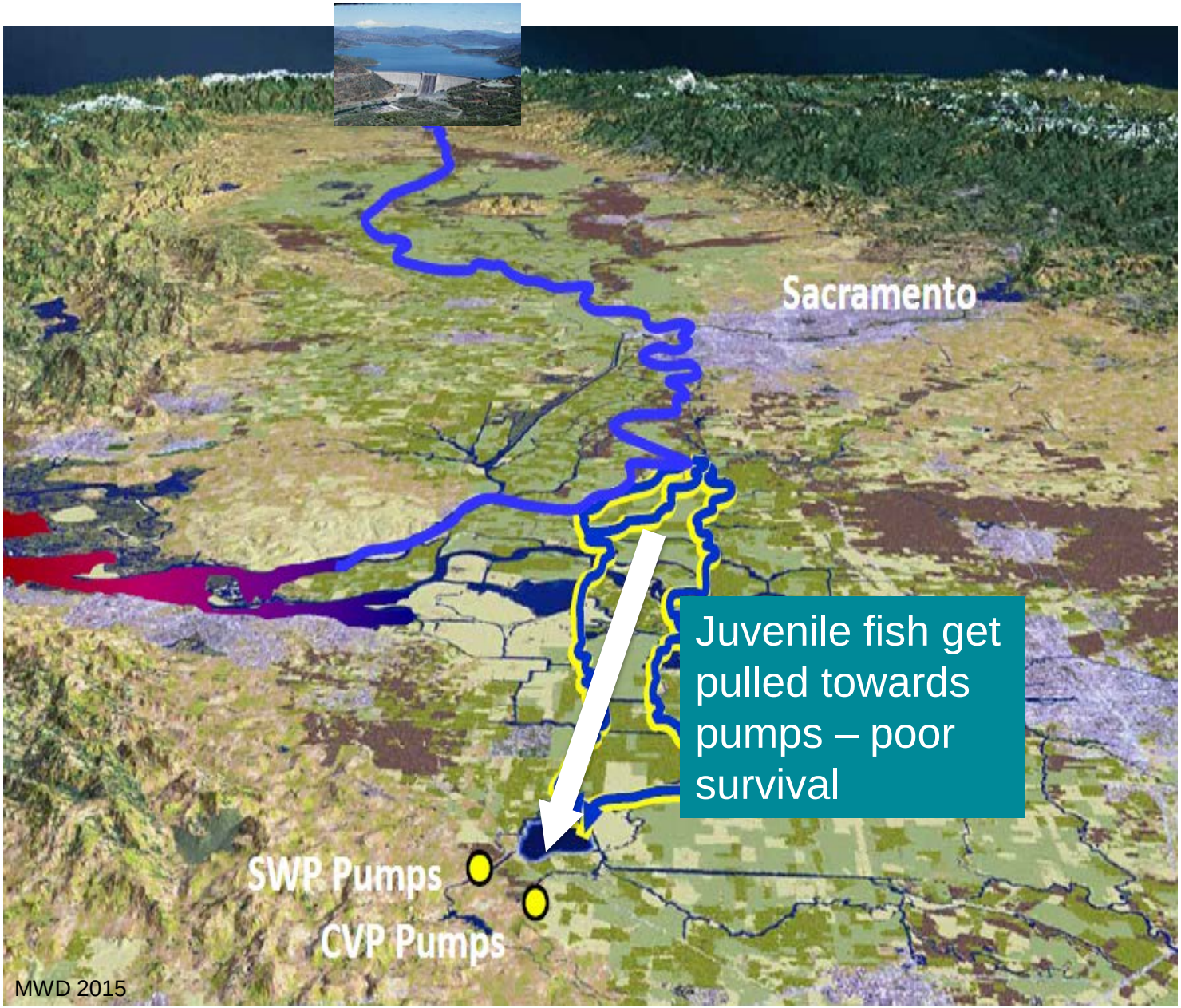

Sacramento
Juvenile fish get pulled towards pumps – poor survival
SWP Pumps
CVP Pumps
MWD 2015

Reasons for hope

- Population is at moderate risk based on extinction risk criteria

	2010 Status Review	2015 Status Review
Population Size	Low risk	Low risk
Population Decline	Low risk	Moderate risk
Catastrophe, rate, and effect	Low risk	Low risk
Hatchery Influence	Low risk	Moderate risk

- 2016 adults returns likely will still result in low risk based on population size (even with extreme drought and poor ocean conditions)

Winter-run Chinook Salmon Action Plan

Action 1:

Water temperature management for spawners, eggs, and fry

- Model advances (RAFT)
- Improved measurements

(Do not want a repeat of 2014)

Decision Support System

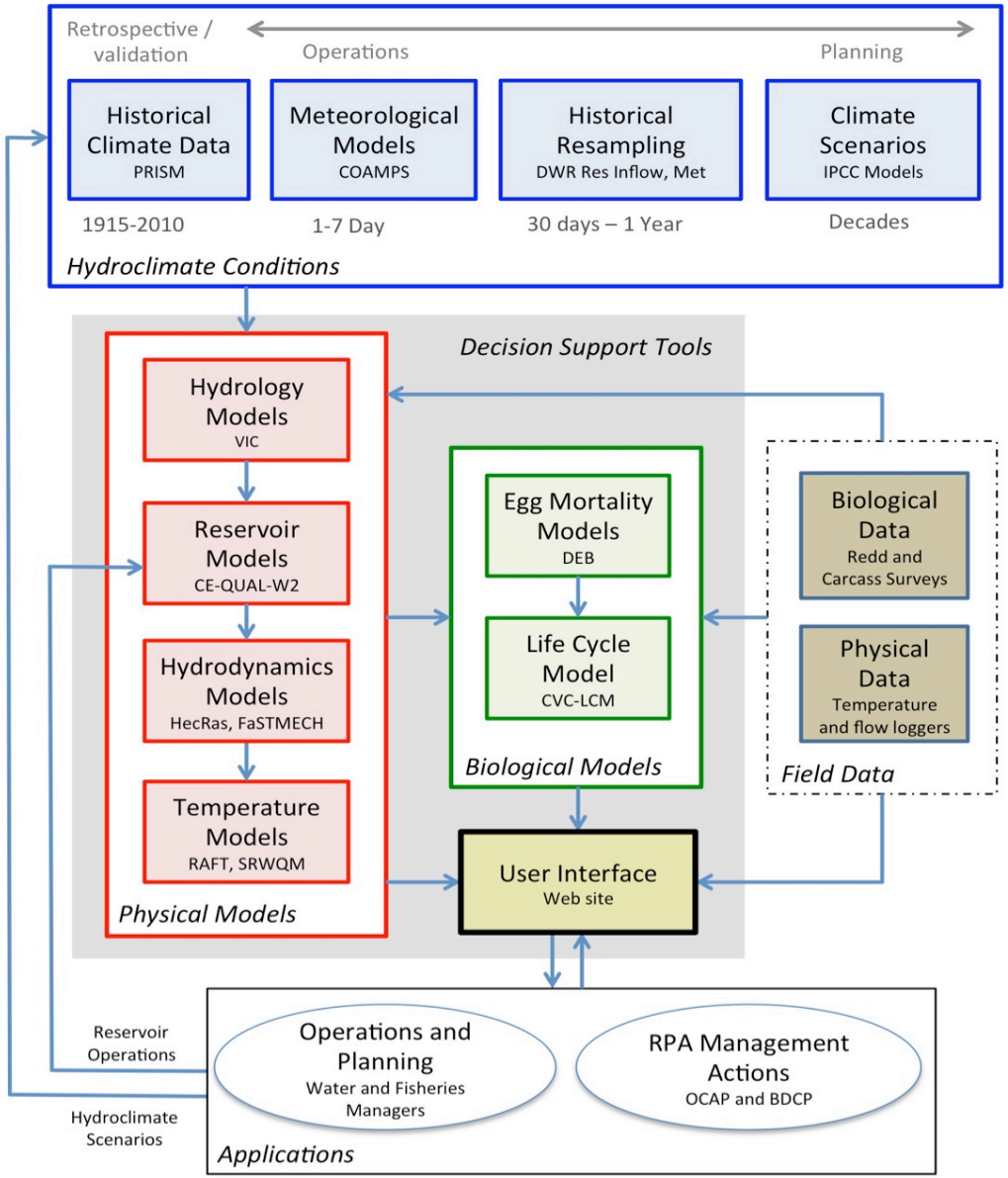


Figure provided by Eric Danner NMFS SWFSC

Non-physical barriers

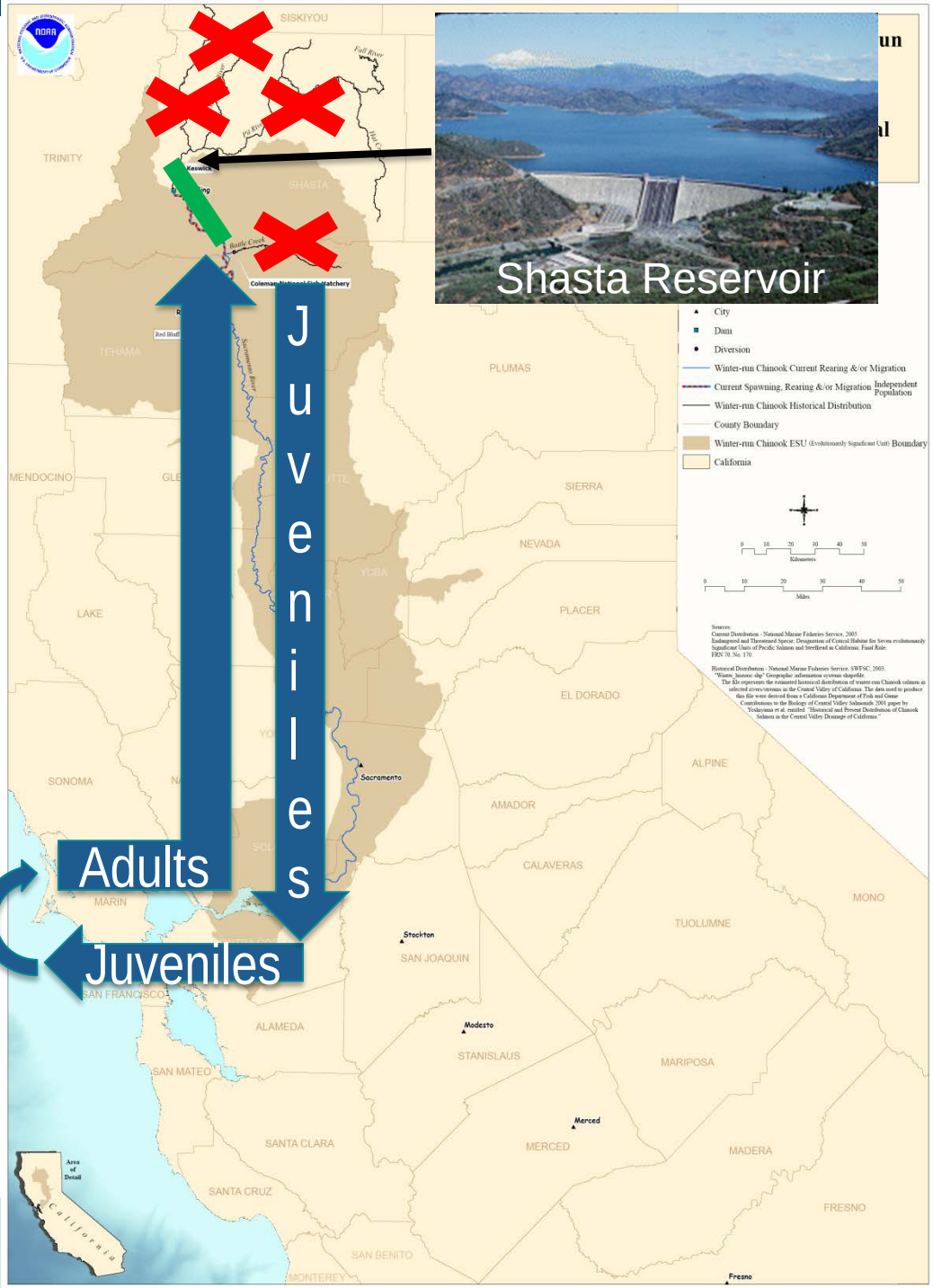
Deter fish from entering the central Delta

Winter-run Chinook salmon

Unique to Sacramento River

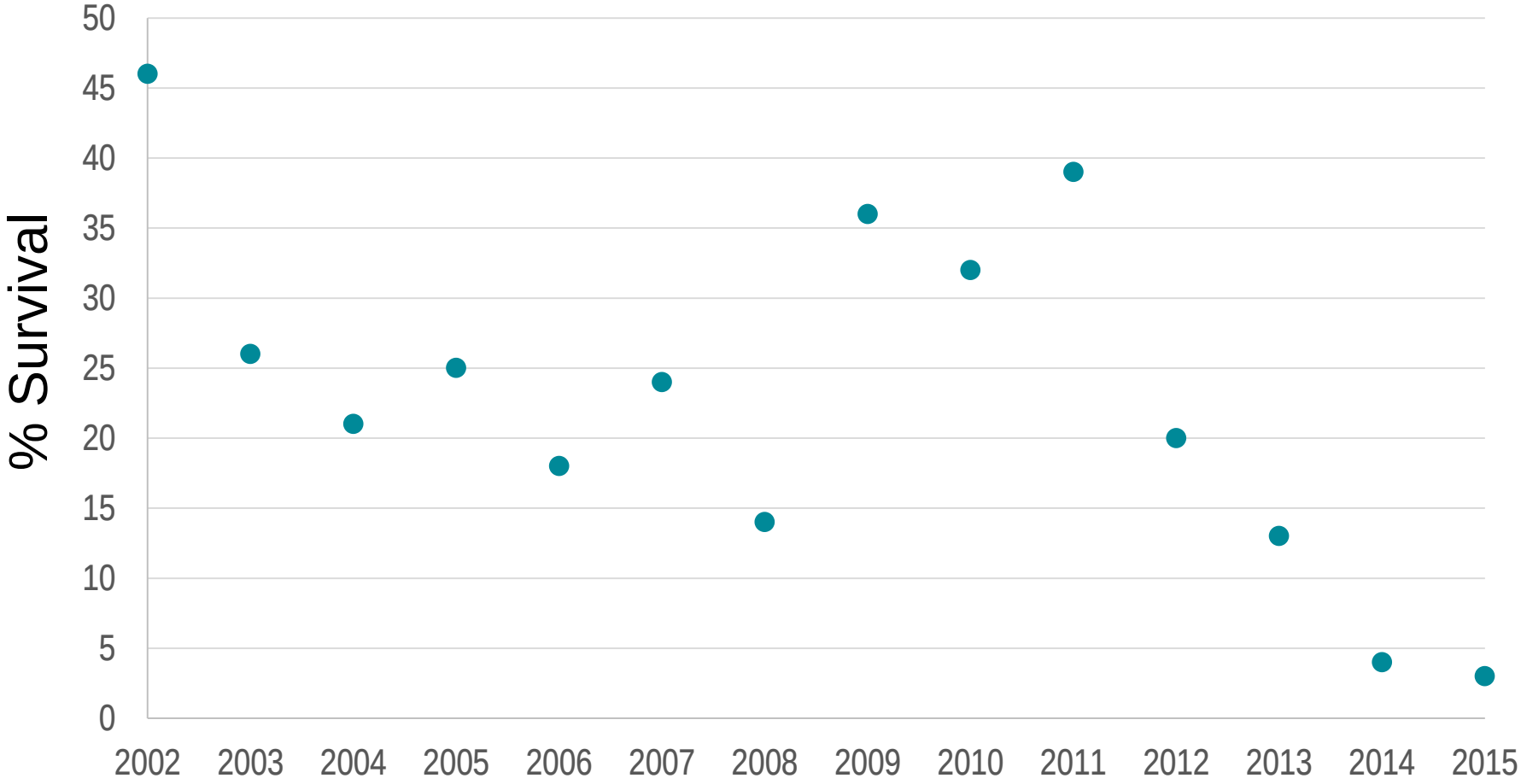
Life History

- Adult migration in winter
- Spawn in spring and summer
- Juveniles spend 5-10 months in freshwater
- Adults spend 1-2 years in ocean



NOAA FISHERIES

Egg to Fry Survival (%)



Reasons for hope

- We're learning a lot!
  - Water temperature management and egg survival
  - Life cycle modeling
  - Predation studies
  - Acoustic tracking
  - Monitoring gaps
- Significant partnerships in agreement on what key restoration needs to be done
- Species in the Spotlight initiative helping to focus existing funding (e.g., CVPIA)
- Restoration funding is increasing
  - CA Prop 1, Fisheries Restoration Grant Program
  - NOAA Restoration Center